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ABSTRACT

This report analyses justifications gathered in a series of studies which led intellectually normal infants' school and nursery school children and mildly mentally retarded special day school children to acquire conservation understanding. Two hundred and five children were given a pretest of number, mass, length, liquid, and weight conservation. Training groups for non-conservers were formed on the basis of pretest results, mental age and chronological age. Trainees participated in three training sessions given approximately one week apart. All trained children received Learning Set or Verbal Rule training. In a posttest, held approximately one week later, justifications for judgments in the conservation tasks were elicited by asking, "How can you tell?" Judgments and justifications for all conservation tests were compared. It was found that cases of paired correct judgments and incorrect justifications as well as paired incorrect judgments and correct justifications were well below the level that might have occurred by chance. Justifications given were of several different types (identity, reversibility, compensation, addition/subtraction, perception or other) and, except for addition/subtraction justifications, were similar across all groups of children. Trained children, especially the retarded trained children, were more likely to offer multiple justifications. Additional trials on tasks produced more information and improved some children's chances to conserve successfully. (Author/RH)

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Justifications: Another Look

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A lively controversy concerns the importance, in a Piagetian conservation study, of asking the child to describe why he answered as he did in a task, to justify his conserving or nonconserving judgments.

Those critical of this procedure (Brainerd, 1973, 1974, 1977; Rosenthal & Zimmerman, 1972) cite the likelihood of incurring a Type II error, a false negative. Brainerd suggests that the child may be deemed a nonconserver when in fact he conserves, but cannot give an acceptable justification, perhaps because of insufficient verbal skills, lapses of attention, misunderstanding of instructions, and so on. Brainerd asserts that there is no reason to expect systematic Type I errors, that is, false positives, deeming children to be conservers when in fact they are not.

Others hold different views. Reese & Schack (1974) argue that Type I and Type II errors are approximately equally likely to occur, and they suggest that both judgments and justifications be used and their interrelations studied. Beilin (1968, 1976) argues that a judgments-only criterion fails to reveal the nature of the underlying structures. He points out that for Piaget, and for others, concrete operational thought is far more than rule-regulated behavior. A judgments-only response cannot provide knowledge of the child's consciousness of the events with which she is dealing.

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This paper will report analyses of justifications gathered in a series of studies which led intellectually normal and mildly mentally retarded children to acquire conservation understanding. It will be argued that important observed relationships could not have been discovered without the consideration of justifications.

Method

Subjects

This paper reports work with 205 children, as described in Table 1. Approximately half were mildly mentally retarded children from two special day schools in London for Educationally Subnormal children, hence the title ESN. The intellectually normal children were pupils in an Infants school in London or attended the two nursery schools which are associated with the Child Study Center of the University of California, Berkeley. Mental age for all children was determined with the Peabody Picture Vocabulary Test. Control group children who were a part of each experiment but were not trained are not included in these figures, nor are those children who were tested but not used because they did not meet the particular criteria of each experiment.

In addition, 103 of these children participated in a follow-up posttest given 2½, 4, 5, or 16 months after the first. Results of this second posttest also will be reported, when appropriate, yielding a total of 308 tests of conservation.

Procedure

Each child received a pretest of number, mass, length, liquid, and weight conservation. Those who were determined to be nonconservers and whose mental age (MA) and chronological age (CA) agreed with the specifica-

tions of the particular experiment became part of the training groups and participated in three training sessions given approximately one week apart. All trained children received Learning Set or Verbal Rule training, described elsewhere (Field, 1974, 1977, 1978a). Only number and length quantities were trained. In the posttest, held approximately one week later, justifications were elicited by asking "How can you tell?" after each judgment of each transformation of each of the five tested quantities.

Justifications were coded as identity, reversibility, compensation, addition/subtraction, perceptual, or other.

Results

Type I - Type II

First, let us examine the validity of the Type II error in this situation. If this is indeed a problem, then one would expect to consistently and frequently find children who judged a display correctly but could not provide acceptable explanations for these judgments. I reanalyzed all 308 conservation tests, tabulating judgments only and justifications only. I examined these for each of the four types of children: trained ESNs, naturally conserving ESNs, trained normal children, and naturally conserving normal children. Each quantity was subject to two transformations. Most tests measured five quantities.

I did not compare judgments and justifications when only one of the two transformations had been judged correctly for a quantity, for surely no one believes that one question and answer is sufficient to determine conservation in a child. However, I did find that there were some cases when a child gave two conserving judgments to a quantity but failed to give adequate justifications to support them. It can be seen in Table 2

that this occurred 38 times: only 38 times in tests of about 1500 quantities! This can hardly be considered a problem of the first importance.

Natural conservers were more likely than the trained conservers to offer good judgments without good justifications. Piaget would describe most of these children as transitionals, not conservers, and I think that he is probably right.

Furthermore, I do not believe that a child can be judged a "conserver" on the basis of a test of one quantity only. It is necessary, I think, to look at the child's performance on all parts of the conservation test. Investigation of the data revealed that in almost all cases the child made this kind of error on only one of the five quantities tested. Only six children, four ESN and two normal, provided correct judgments without adequate justifications for more than one quantity.

One of the nonretarded children correctly judged but could not justify all four quantities she "conserved". Two of the four retarded children I remember to this day. One was a child who would not talk, even after five sessions; lots of reinforcements, tangible and intangible, and good rapport with the investigator. I could see him counting the checkers after giving his conserving judgments, so scored him as a conserver of number, but there were no clues for his conserving judgments of the other quantities. The other child replied, "I can see it: I've got my glasses on!" To the next transformation, he replied, "Even if I take my glasses off (and he demonstrated) I still can see it!" Probably these two retarded boys really were conservers. Certainly this is a stringent test for such children. What seems to me more remarkable is how competent those other 99 usually rather nonverbal retarded children were at explaining their own reasoning. They were in no way parroting back explanations learned by rote or by modeling, as reported here last year (Field, 1978b).

Justifications without Judgments. Interestingly, I found seven instances where a child gave good conserving justifications to nonconserving judgments. An example was a child who conserved all quantities up to weight, but after she herself rolled a ball of plasticene into a snake about 24 inches long, responded to my query, "Oh no! It's such a long, thin snake; it couldn't possible weigh the same!" All those who gave these justifications without judgments were children of normal intelligence, and no child did this more than once.

Discussion. The evidence here indicates that the problem of Type II error may be a tempest in a teapot. The results corroborate the arguments of Reese & Schack (1974). They also provide strong confirmation of Beilin's (1968, 1976) arguments regarding the crucial issue of understanding the underlying structures. Since so much information is gained about the child's cognitive processes through a consideration of justifications, there can be little question about the value of their use. What types of justifications were offered by the different sorts of children?

And now that we have, perhaps, disposed of the tempest, we can turn to the more interesting examination of what it is that a study of justifications can reveal.

A year ago at these meetings (Field, 1978b) I showed that normal and retarded children are very similar in the way they respond to training, as measured by the quantities conserved on posttests, particularly quantities which were not trained. The kind of verbal training that is effective for retarded children is also effective for children of normal intelligence, and training which does not provide a good strategy for one group does not work any better for the other group.

Justifications offered by these children show very similar results. Figure 1 shows that the patterns of responses were remarkably similar for all four groups of children. Trained and naturally conserving, mentally retarded and nonretarded, the groups were not different except in one instance. Addition/subtraction justifications were given almost exclusively by natural conservers of normal intelligence. A/S is the most analytical of the identity justifications, and its appearance only among the naturally conserving normal children may very well be indicative of true differences in the quality of conservation mastery demonstrated by this group.

Table 3 tabulates each of the different types of justifications. I and R were given significantly more often by trained children. I was also used as an explanation significantly more often by retarded children. It is an unexpected finding that R was so much more prevalent among trained children, for many investigators, including Piaget, have concluded that reversibility is at the heart of conservation understanding. Yet trained children used this justification more than the naturally conserving, and in all groups it was used less than I. Table 3-C indicates that compensation is not at the heart of conservation understanding. As the compensation strategy was not of value in inducing conservation understanding, it was not likely that compensation would be offered as an explanation, either.

Multiple Justification

Trained children, especially the retarded trained children, were much more likely to offer multiple justifications. For example, a child might say "Well, of course it's still the same amount of plasticene; here, I'll roll it back into a ball and show you." This response was scored as including both I and R. Table 4 shows that the trained children were significantly more likely to offer these multiple justifications than natural conservers,

and ESN children were more likely to produce multiple justifications than normal children.

How can it be that these retarded children, not a notably verbal group, could offer such complete explanations? I would like to speculate about this, and it is speculation now. The retarded children enjoyed the "games"; they valued the time away from the hurley-burley of their classrooms, the tangible and intangible reinforcements, and the praise they so rarely received elsewhere, and they engaged in activities which tended to prolong the sessions. Giving lots of justifications was a good way of prolonging the sessions, and they did so. The nonretarded children, whose other resources were so much greater, were not so much inclined to do this.

How can it be that the trained children gave so many more justifications than the natural conservers? Let me speculate again. The trained children had five enjoyable sessions of "games", individual attention, lots of praise, and sweets or raisins over the course of several weeks. By the posttest each child and the experimenter were friends. The natural conservers, on the other hand, were seen only once. I think the rapport built up over the longer period was an important condition, and I think this is one reason why the results of these experiments have been more favorable than those reported by many investigators who saw the child only once or twice.

The Advantages of Asking Children More Questions.

In this paper I have examined posttest results for two transformations of each of the quantities, in order that data would be comparable for all children in all experiments. However, as part of four of the six experiments, there were two further transformations for each quantity, and justifications were required for these as well. Analysis of these additional

trials shows that more information is gained when the investigator takes the trouble to inquire at length, and the children given further opportunities to display their understanding.

For example, of the 84 children who participated in the more extensive posttests, 20 gave a conserving judgment on the third or fourth transformation who had not done so on the first or second transformation for that quantity. Seven of these were normal children, and 13 were ESNs. None of these children would have been deemed a conserver on the basis of their third and fourth judgments and justifications alone, however.

More important, many of the children who participated in the more extensive posttests offered justifications that differed in the latter transformations from those given on the first two. Not all children varied their responses; some fastened on a response which satisfied them and stuck with it throughout. But 41% of the retarded and 33% of the normal children were more enterprising and produced new and different explanations on the third and fourth transformations of many of the quantities. The data cannot reveal the reasons for this broadening of responses with additional transformations, but it is easy to speculate. Perhaps they, like many adults, got tired of saying the same thing and enlivened the games by inventing new answers. If this is so, isn't it remarkable that the retarded children were able to do this, and did so to an even greater extent than the nonretarded children.

Conclusion

As Gruen (1966) observed some years ago, the choice of criteria depends on the psychological processes that one assumes underlie con-

servation. If, like the neobehaviorists, you are looking for rule-regulated behavior, then the inclusion of justifications in a study is an unnecessary frill. But if, like Piaget and most of us here, you are interested in how children structure the world, in logical operations, and in children's consciousness of the events with which they deal, then essential information is contained in these explanations, and you will find them valuable indeed.

References

Beilin, H. Cognitive capacities of young children: A replication. Science, 1968, 162, 920-921.

Beilin, H. Constructing cognitive operations linguistically. In H. W. Reese (Ed.) Advances in Child Development and Behavior, Vol. 11, New York: Academic Press, 1976.

Brainerd, C. J. Judgments and explanations as criteria for the presence of cognitive structures. Psychological Bulletin, 1973, 79, 172-179.

Brainerd, C. J. Postmortem on judgments, explanations, and Piagetian cognitive structures. Psychological Bulletin, 1974, 81, 70-71.

Brainerd, C. J. Response criteria in concept development research. Child Development, 1977, 48, 360-366.

Field, D. Long-term effects of conservation training with educationally subnormal children. Journal of Special Education, 1974, 8, 237-245.

Field, D. The importance of the verbal content in the training of Piagetian conservation skills. Child Development, 1977, 48, 1583-1592.

Field, D. How children in educationally subnormal schools in London learn conservation skills. In G. L. Lubin, M. K. Poulsen, J. F. Magery, & M. Soto-McAlister (Eds.) Piagetian Theory and its Implications for the Helping Professions. Proceedings of the Seventh Interdisciplinary Conference, Vol 2. Los Angeles: University of Southern California Press, 1978 (a).

Field, D. Identity, reversibility, and compensation: An examination. Paper presented to the meetings of the Jean Piaget Society, Philadelphia, May, 1978 (b).

Field, D. Type I, Type II, and Piaget. Paper presented to the meetings of the Western Psychological Association, San Diego, April, 1979.

Gruen, G. E. A note on conservation: Methodological and definitional considerations. Child Development, 1966, 37, 977-983.

Reese, H. W., & Schack, M. L. Comment on Brainerd's criteria for cognitive structures. Psychological Bulletin, 1974, 81, 341-355.

Rosenthal, T. L., & Zimmerman, B. J. Modeling by exemplification and instruction in training conservation. Developmental Psychology, 1972, 6, 392-401.

Table 1

Children Under Study

	Trained Subjects	Natural Conservers
Mildly Mentally Retarded (ESN)	N = 74 CA: 6-9 - 14-2 MA: 3-10 - 11-9	N = 30 CA: 8-1 - 12-11 MA: 5-2 - 10-5
Children of normal intelligence	N = 71 CA: 3-0 - 5-9 MA: 3-3 - 7-4	N = 30 CA: 4-11 - 5-8 MA: 4-7 - 10-7

Table 2

Number of Children
Offering Conserving Judgments
Without Conserving Justifications
on One or More Quantities at any Time

	Trained	Natural
ESN	15	10
Normal	5	8

Note: Possible occurrences, approximately 1500

Table 3

Comparing the Groups of Children for the
Number of Types of Justifications Given in the Posttest

Table 3-A

Prevalence of I-Justifications

	Trained	Natural
ESN	168	56
Normal	112	54

2-way Anova

	F(1,201)	p<
IQ	19.81	.001
Treatment	11.68	.001
Interaction	18.61	.0001

Table 3-B

Prevalence of R-Justifications

	Trained	Natural
ESN	101	27
Normal	86	13

2-way Anova

	F(1,201)	p<
IQ	15.88	.004
Treatment	8.29	.01
Interaction	.00	NS

Table 3-C

Prevalence of C-Justifications

	Trained	Natural
ESN	12	9
Normal	10	5

2-way Anova

	F(1,201)	p<
IQ	3.97	.05
Treatment	.01	NS
Interaction	.02	NS

Table 4

Comparing the Groups of Children
for the Numbers who Gave
More than One Type of Justification in Explanation
of Conservation Judgments of a Single Quantity

	Trained	Natural
ESN	43 (59.7%)	12 (38.7%)
Normal	30 (42.9%)	4 (12.9%)

2-way Anova

	F(1,201)	p<
IQ	7.97	.005
Treatment	10.05	.002
Interaction	2.75	NS

Figure 1

Comparing the Groups of Children for
Percent of Justifications of each Type
Offered in All Posttests